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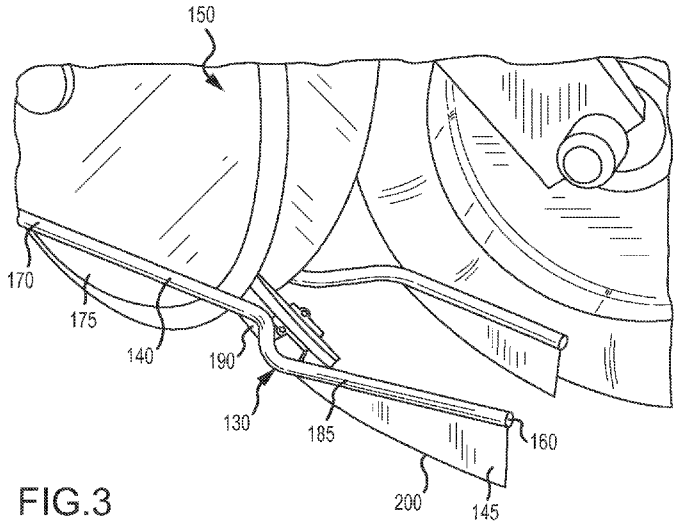


FIG.3

(57) Abstract: A blade attachment for use with a planter unit may include a first member and a second member extending from an attachment structure. The first and second members may taper towards each other at rear portions of the first and second members. A first blade may extend from the rear portion of the first member, and a second blade may extend from the rear portion of the second member. The blades may be configured to close a furrow formed by the planter unit by pushing the soil into the furrow. The blades may be arranged at an angle relative to each other, relative to their respective rear portions, and/or may be adjustable to facilitate pushing the soil into the furrow. The blades may facilitate closing of the furrow ahead of the press wheel of a furrow closer.

BLADE ATTACHMENT FOR PLANTER UNIT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit, under 35 U.S.C. § 119(e), of U.S. Provisional Application No. 61/478,269, entitled "Blade Attachment for Planter Unit" and filed on April 22, 2011, and U.S. Provisional Application No. 61/565,049, entitled "Blade Attachment for Planter Unit" and filed on November 30, 2011. Both of these applications are hereby incorporated herein in their entireties.

TECHNICAL FIELD

[0002] The technical field relates to attachments for seed planter units or drills, and more particularly relates to blade attachments for planter units for improving seed-to-soil contact in seed furrows.

BACKGROUND

[0003] Seed planter units may include a number of planter row units mounted on a main frame member. During seed planting, the planter unit is generally pulled in a forward direction by a tractor. Each row unit forms a seed furrow utilizing a furrow opener, deposits seeds evenly along the seed furrow, and then closes the seed furrow to form a seed bed utilizing furrow press wheels, which trail behind the furrow opener and gauge wheels.

[0004] For firmer, wetter soils, when the seed furrow is wedged open by the furrow opener to form a V-shape, the soil compacts due to the discs of the furrow opener running along the soil at an angle with the front of the discs pitched in on the front side and out on the back side of the discs. This wedging action causes the soil to compact on the sides of the seed furrow making it difficult for the trailing furrow closer press wheel (or wheels) to close the seed furrow properly behind the disc or discs of the furrow opener. To overcome this problem, downward pressure on the row units may be increased to facilitate closing the seed furrow properly. With this added downward pressure on the row unit, an upward pressure on the bar of the planter unit or drill may cause the disc of the furrow opener to ride up and out of the ground. This may cause the disc of the furrow opener to form shallow furrows, resulting in shallow planted seeds.

[0005] For row units spaced closer together on the planter unit or drill bar, for example, where the planter unit includes an increased number of row units, greater downward pressure may be required for the furrow opener to form the furrow. However, this added downward pressure results in an increased upward pressure being exerted on the bar above

the row units. To overcome this problem, weight may be added to the drill bar in order for the row units, and therefore the disc of the furrow opener, to penetrate the soil. However, this may create more compaction in the soil, which may prevent the press wheel of the furrow closer from properly closing the furrow. Generally, different sized press wheel combinations are utilized to compensate for the aforementioned problems related to closing furrows.

SUMMARY

[0006] Described herein is a blade attachment for use with planter units that may close or partially close a furrow. The blade attachment may include an attachment structure, at least one member, and at least one blade for pushing soil into an open furrow. The blade attachment may be joined to the planter unit at a front portion of the planter unit via the attachment structure. The member may extend from the attachment structure, along the discs of a furrow opener, and past a trailing edge of the discs. The blade may be joined to the member in the area of the member positioned beyond the trailing edge of the discs of the furrow opener. The blade may extend from the member so that a portion of the blade contacts soil of the opened furrow in an area where soil is to be pushed into the furrow. For example, the blade may be positioned in soil so that the blade contacts the soil at the sides of the open furrow, for example, the sides of a V-shaped furrow, to close or facilitate closing of the furrow ahead of the press wheel of a furrow closer, when present.

[0007] According to one embodiment, a blade attachment for use with a planter unit may include a first member, a second member, an attachment structure, a first blade, and a second blade. The first member and the second member may extend from the attachment structure. The first member and second member each may terminate in a free end at a rear portion of each member. The first blade may extend from the rear portion of the first member. The second blade may extend from the rear portion of the second member. The rear portion of the first member and the rear portion of the second member may taper towards each other. The blades may be configured to close a furrow formed by the planter unit by pushing soil into the furrow.

[0008] According to another embodiment, a method for closing a seed furrow may include forming an open furrow utilizing a furrow opener of the planter unit. The method may further include depositing a seed in the open furrow utilizing a seed tube, and closing the furrow using blades of a blade attachment joined to the planter unit, where the blades push soil into the open furrow. The blade attachment may include a first member and a second member extending from an attachment structure. The first and second members may taper towards

each other at a rear portion of the blade attachment, and each blade may extend from a rear portion of one of the first and second members.

[0009] While multiple embodiments are disclosed, still other embodiments of the present disclosure will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the disclosure. As will be realized, the disclosure is capable of modifications in various aspects, all without departing from the scope of the present disclosure. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Fig. 1 is a perspective view of a planter unit.

[0011] Fig. 2 is an elevation view of a planter unit with a blade attachment.

[0012] Fig. 3 is a perspective view of the blade attachment shown in Fig. 2.

[0013] Figs. 4A-4G are perspective views of various possible blade attachments.

[0014] Fig. 5A shows rear elevation views of the blade with one or more braces.

[0015] Fig. 5B is a side elevation view of the blade with braces at the top and bottom edges.

[0016] Fig. 6A is a top plan view of the blade attachment with a selectively adjustable rear portion.

[0017] Fig. 6B is a cross-section view of the blade attachment shown in Fig. 6A, viewed along line 6B-6B in Fig. 6A.

[0018] Fig. 6C shows schematic rear elevation views of the blade attachment.

[0019] Fig. 7A shows top plan views of the blade attachments with selectively adjustable rear portions.

[0020] Fig. 7B is a cross-section view of one of the blade attachments shown in Fig. 7A, viewed along line 7B-7B in Fig. 7A.

[0021] Fig. 8 is an elevation view of a planter unit with a blade attachment.

[0022] Fig. 9 is an elevation view of a planter unit with a blade attachment.

[0023] Fig. 10 is an elevation view of a planter unit with a blade attachment.

DESCRIPTION

[0024] The blade attachments described herein may be used with a variety of planter units and drills. The blade attachments may include an attachment structure, at least one member, and at least one blade. Each blade may push soil into an open furrow. In some embodiments, one or more braces may be joined to each blade. The braces may be used to increase the strength or the durability of the blade. In some implementations, a blade attachment may be provided for each furrow opener of a planter unit. However, more or less blade attachments may be provided on the planter unit as desired.

[0025] Fig. 1 shows a seed planter unit. The seed planter unit 100 may include a number of planter row units 105 mounted on a main frame member 110. During seed planting, the planter unit 100 may generally be pulled in a forward direction by a tractor 115. Each row unit 105 may form a seed furrow utilizing a furrow opener, deposit seeds in the seed furrow, and then close the seed furrow to form a seed bed. Furrow press wheels 120, which trail behind the furrow opener and gauge wheels 125, may be used to close the seed furrow.

[0026] Figs. 2 and 3 show one example of a blade attachment 130. With reference to these figures, the blade attachment 130 may include an attachment structure 135, one or more members 140, and one or more blades 145. The blade attachment 130 may be joined to a seed planter unit 100. In some implementations, a blade attachment 130 may be provided for each furrow opener of a planter unit 105. However, more or less blade attachments 130 may be provided on the seed planter unit 100 as desired.

[0027] The attachment structure 135 of the blade attachment 130 may be used to anchor the blade attachment 130 to a front portion of the planter unit 100 ahead of the discs of the furrow opener 150 of a row unit 105. The attachment structure 135 may be made of made of steel or another suitable material and may have a cylindrical, tubular, square, rectangular, or other cross-sectional shape. The attachment structure may be welded, mechanically joined (e.g., by fasteners or the like), adhered, or otherwise suitably joined to the planter structure 100.

[0028] In some embodiments, the attachment structure may include a boss 155. In other embodiments, the boss 155, when used, may be formed on the planter unit 100. A fastener may be used in conjunction with the boss 155 to secure the blade attachment 130 to the planter unit 100, for example, in an area adjacent to and/or above the furrow opener 150 of the planter unit 100. The boss 155 and fastener may form a connection by any suitable means. For example, a boss 155 of the blade attachment 130 and a fastener of the planter unit 100 may be sized and configured so that the planter unit fastener is joined to the boss 155 by a press or interference fit. As another example, the boss 155 and a planter unit fastener may each include threads so that these components are joined via a threaded connection. In other examples, the boss 155 of either the planter unit 100 or the blade attachment 130 and the fastener of the other of the planter unit 100 and the blade attachment 130 may be secured by adhesion, welds, or other suitable connection means.

[0029] The blade attachment 130 may include one or more members 140. Each member 140 of the blade attachment 130 may extend from the attachment structure 135 downwardly on a side of the furrow opener 150 and may terminate in a free end 160. The members 140 may be made of steel or another suitable material and may have a cylindrical, tubular, square, rectangular, or other cross-sectional shape. A member 140 may be provided on each of the two sides of the furrow opener 150 (one member being shown in Fig. 2), with

each of the two members 140 extending adjacent to and near the outer edge of each of the discs of the furrow opener 150.

[0030] A front portion 165 of each member 140 may attach in a fixed manner to the attachment structure 135, which may be joined to the front portion of the planter unit 100 adjacent the row unit 105. The members 140 of the blade attachment 130 may be separate pieces of material that are attached to the attachment structure 135. Alternatively, the attachment structure 135 and the members 140 may be one continuous piece of material that is configured to be joined to the front portion of the planter unit 100 and that allow each member 140 to extend rearwardly and downwardly from the attachment structure 135. If the blade attachment 130 is formed as a single integral member, attachment of the members 140 and the attachment structure 135 to the front portion of the planter unit 100 may be by a fixed attachment. This may anchor the upper end of the front portion 165 of each member 140 to the front portion of the planter unit 100 in order to enable the remaining length of each member 140 to bend or flex relative to the attachment point. The length of the front portion 165 of each member 140 may correspond to a distance between the point of attachment of the attachment structure 135 to the planter unit 100 and a bottom region of the disc of the furrow opener 105. At a lower end of the front portion 165 of each member 140, each member 140 may angle at a generally obtuse or right angle to the adjacent middle portion 170 of each member 140.

[0031] The middle portion 170 of each member 140 may extend at an angle downwardly and rearwardly, and close to, but not necessarily touching, the outer surface of the disc 175 of the furrow opener 150. That is, the members 140 may extend from the leading edge to the trailing edge of the discs 175 of the furrow opener 150 along a lower third, quarter, or fifth portion of the discs 175, and may follow the angle of the discs 175, but may not necessarily contact or otherwise engage to the discs 175. For example, furrow openers 150 having two circular disc blades 175 rotatably mounted on the row unit 105 generally form a V-shape, and the members 140 may follow the V-shape of the circular discs 175. Thus, the discs 175 of the furrow opener 150 may freely rotate about the hub 180 of the discs 175, independently from the blade attachment 130.

[0032] The middle portion 170 of the members 140 may extend beyond a perimeter of the discs 175 at the trailing ends of the discs 175. Beyond the perimeter of the discs 175 of the furrow opener 150, the members 140 may transition outwardly at an angle or bend relative to a longitudinal axis of the middle portion of the member 140 and then extend rearwardly to the free, terminal end 160. The outwardly angled portion or bend of each member 140 may include a length corresponding to the furrow width so that a distance between the members 140 at their respective free ends 160 is at least as wide as the furrow formed by the furrow opener. The portion of the members 140 that extend rearwardly from the outwardly angled

portion or bend may be referred to as the rear portion 185 of the member 140. The rear portion 185 of each member 140 may extend parallel to, or at an angle, relative to the trailing edge of the disc 175 of the furrow opener 150, and/or at an angle relative to the angle that the members 140 extend along the disc 175 of the furrow opener 150. The rear portions 185 may be sufficiently long so that the blades 145 joined thereto are clear of a seed tube 190 and a furrow cover 195 to allow the blades 145 to close the furrow after seed placement.

[0033] While the blade attachment 130 is anchored on the planter unit 100, the member 140 may deflect or flex at or below the connection point of the attachment structure 135 to the planter unit 100, for example, at the attachment structure 135 and/or at a portion where the members 140 are angled proximate a leading, lower portion of the disc 175 of the furrow opener 150. The member 140 may be made to be flexible or resilient so that it may deflect from an at rest position and apply a biasing force against an object, such as the ground, that flexes the member 140 away from its rest position.

[0034] Each member 140 may include a blade 145. Each blade 145 may be relatively rigid and may be formed of a metal, such as steel, stainless steel, aluminum, and the like, or any other suitable material. Each blade 145 may extend from the rear portion 185 of each member 140, for example, the portion of the member 140 that extends rearwardly from the bend portion mentioned above. With reference to Fig. 3, each blade 145 may be joined to the member 140 by connecting a top edge of the blade 145 to a bottom surface of the rear portion 185 of the member 140. However, each blade 145 may be joined to a respective member 140 at other surfaces of the rear portion 185 of the member 140. Each blade 145 may extend along the rear portion 185 of its respective member 140 towards the free end 160 of the member 140 and may extend downwardly in a substantially vertical direction from the rear portion 185 of the member 140. In some embodiments, each blade 145 may extend from the member 140 at an angle relative to vertical so that the bottom region of each blade 145 is closer to the bottom region of an opposing blade 145 than the top regions of each blade 145 are to each other. Further, each blade 145 may be adjustably angled relative to vertical.

[0035] Each blade 145 may include a tapered or fin shape with the depth of the blade 145 greater at a rear or trailing portion of the blade 145 than at a front or leading portion of the blade 145. Further each blade 145 may be narrow at the front or leading portion of the blade 145 and wide at the rear or trailing portion of the blade 145. The depth at the rear or trailing edge of each blade 145 may be approximately 2 to 3 inches or any other desired depth. A lower edge 200 of each blade 145 that defines the taper from the rear portion to the front portion of the blade 145 may be curved, flat, curved convexly or concavely, or other shapes and may include multiple curves, no curves, linear or non-linear transition lines, or other desired lines. Each blade 145 may be joined to the rear portion 185 of the member 140 by a

suitable connection mechanism, such as by welding, mechanical fasteners (e.g., threaded screw and nut assemblies), and so on.

[0036] The blades 145 may generally taper towards each other as they extend towards the free end 160 of their respective members 140 due to the arrangement of the rear portion 185 of the members 140 tapering towards each other. That is, the blades 145 may extend along the same or a similar angle to the angle at which the rear portions 185 of the members 140 extend. Each of the blades 145 may be provided with a different depth, thickness, or taper, which may facilitate shaping of the furrow. The blades 145 may also have an angle or offset relative to vertical that is adjustable.

[0037] Figs. 4A-4G show various implementations of the blade attachment 130. Each blade attachment 130 may include a U-shaped attachment structure 135 at a front end of the blade attachment 130 and two members 140 that depend downwardly from the attachment structure 135. The members 140, together with the attachment structure 135, may form a fork-like structure. The members 140 extend generally vertically downwardly and turn at a generally obtuse or right angle. The angled portion of the members 140 may turn outwardly and then extend generally rearwardly to form the rear portion 185 of the members 140. The members 140 at the rear portion 185 may taper towards each other as the rear portions extend rearwardly to their respective free ends.

[0038] With reference to Fig. 4A, in a first implementation of the blade attachment 130, the members 140 may not include a blade at the rear portion 185. In this implementation, the rear portion 185 of the members 140 may be configured to push soil and/or ride along the soil as the planter unit moves along ground.

[0039] With reference to Fig. 4B, in a second implementation of the blade attachment 130, a blade 145 may be joined to the rear portion 185 of each member 140 via a mechanical connecting device 205, such as a boss and fastener device. The blades 145 may be detached using the connecting device 205 and rotated or changed with other blades 145. For example, the blades 145 in the second implementation may be double sided by providing a blade edge at the top and bottom of the blade 145, and each blade edge may have a length and taper angle that is different from the other.

[0040] With reference to Fig. 4C, in a third implementation of the blade attachment 130, the blades 145 may be welded or otherwise affixed to the rear portions 185 of the members 140. The blades 145 may additionally or alternatively be joined to one or more braces 210 joined to the rear portions 185 of the members 140. The braces 210 may be formed of a rigid material, such as steel, stainless steel, aluminum and the like, and may provide support to the blade 145 and/or the rear portion 185 of the member 140 during operation of the blade attachment 130.

[0041] Fig. 5A shows rear elevation views of the blade 145 with various possible locations and connection methods for the braces 210. With reference to this figure, a brace 210 may be joined a top, upper left side, or upper right side of the blade 145, and another brace 210 may be joined to the bottom, lower left side, or lower right side of the blade 145. The brace 210 may be welded or otherwise joined to the blade 145, for example, by a boss and fastener connection. In implementations where two or more braces 210 are provided on the blade 145, some or all of the braces 210 may be joined to the rear portion 185 of the member 140. Fig. 5B shows a side elevation view of the blade 145 with braces 210 joined thereto in an area proximate the top and bottom edges of the blade 145.

[0042] With reference to Figs. 4D and 4E, in fourth and fifth implementations of the blade attachment 130, fertilizer tubes 215 may extend from the planter unit (not shown) to the attachment structure 135 and along the members 140 up to the free end where the fertilizer tubes 215 turn downwardly towards an object, such as soil. In the fourth implementation, the fertilizer tube 215 terminates at an opening that is arranged behind a rear edge of the blade 145 so that fertilizer is applied just slightly to the sides of the closed or partially closed furrow. That is, after the blades 145 have contacted and pushed the soil into the furrow, the fertilizer tubes 215 apply fertilizer to the soil.

[0043] In the fifth implementation, the fertilizer tube 215 terminates at an opening that is arranged to the side of the member 140 just prior to the member transitioning to the rear portion 185 carrying the blade 145. In this implementation, fertilizer is applied before the blades 145 have contacted the open furrow. The fertilizer tubes 215 may extend outwardly away from the members 140 by a sufficient distance so that the applied fertilizer contacts soil that is not contacted by the blades 145. In this example, fertilizer may not necessarily be pushed onto the seed and/or into the furrow, which may be useful where a fertilizer is not to be directly applied to the seed. The fertilizer tube 215 in the fifth implementation may thus facilitate depositing fertilizer proximate, but not directly on the seed. In some embodiments, the blade attachment 130 may be configured for transmission of liquid therethrough, for example where the member 140 is a tube or the like. In any of the above cases, the blade attachment 130 may be configured to place the liquid in the furrow, adjacent the furrow on one or both sides, and/or adjacent the furrow and at a particular distance from the centerline of the furrow such as 2 inches, 3 inches, and the like.

[0044] With reference to Fig. 4F, in a sixth implementation of the blade attachment 130, the blades 145 may be adjustably angled relative to vertical as the blades 145 extend downwardly from the rear portion 185 of their respective members 140. For example, compared to the third implementation of the blade attachment 130, the bottom edges of the sixth implementation of the blade attachment 130 may be closer together due to the angle of the blades 145 relative to vertical being adjusted so that the blades 145 angle towards each

other. Thus, the blades 145 converge towards a V-shape. The angle of the blade 145 relative to vertical may be adjusted by bending the blade 145 relative to the rear portion 185 or by rotating the blade 145 about the rear portion 185.

[0045] For example, the blades 145 may be rotated about the rear portion 185 of the member 140 by providing the member 140 with one or more telescopic regions. Figs. 6A and 6B show the member 140 with a telescopic region at the rear portion 185. The telescopic region may include a receiving member 220 and an insertion member 225 with complementary ribs. The blade 145 may be joined to the receiving member 220. By detaching the receiving and insertion members 220, 225, the receiving and insertion members 220, 225 may be rotatably adjusted relative to each other, and upon insertion of the insertion member 225 into the receiving member 220, the ribs may fix the angle of orientation of the receiving and insertion members 220, 225. By selectively adjusting the receiving and insertion members 220, 225 relative to each other at the rear portion 185 of the member 140, the blade 145 may be arranged at a desired angle relative to vertical.

[0046] Fig. 6C shows the blade 145 adjusted at various angles. This adjustment may be useful for moving the bottom edge of the blade 145 towards or away from the bottom edge of its opposing blade 145 in order to adjust the angle at which the blade 145 contacts the soil. By rotating the receiving and insertion members 220, 225 relative to each other at the rear portion 185 of the member 140 (with the blade 145 joined thereto), the distance between the bottom of the blade 145 and the ground may be adjusted downwardly or upwardly. This adjustment may be useful for moving the bottom edge of the blade 145 towards or away from the soil.

[0047] In addition, the blade angle may be adjusted relative to a longitudinal axis defined by the rear portion 185 of the member 140. For example with reference to Fig. 4B among other figures, one or more wedge members may be inserted between the blade 145 and the rear portion 185 so that the blade 145 follows the angle of the wedge. In still other embodiments, the blade attachment 130 may have a hinge point for adjusting the trailing end of the blade attachment 130 relative to the attachment structure 135, and a strut may be provided for securing the desired angle between the trailing end and the attachment structure 135. In still other embodiments, the blade 145 of the blade attachment 130 may be adjustable in a vertical plane and a horizontal plane relative to the member 140.

[0048] With reference to Fig. 4G, in a seventh implementation of the blade attachment 130, the angle of offset of the angled portions, the rear portions 185, and the blades 145 carried thereon may be adjusted. For example, compared to the third implementation of the blade attachment 130, the rear edges of the blades 145 in the seventh implementation of the blade attachment 130 may be closer together due to the increased angle of offset of the blades 145. The angled portions and/or the rear portions 185 carrying the blades 145 may be

adjustable relative to each other by bending or by adjustment areas, such as rotation regions 230. Fig. 7A shows rotation regions 230 at the intersection between the middle portion 170 and the angled portion (i.e., where the angled portion is present on the member 140), and at the intersection between the angled portion and the rear portion 185. With reference to Fig. 7B, the rotation regions 230 may include an engagement structure, such as interlocking ratchet teeth, and a fastener, such as a threaded connector, for enabling the complementary engagement elements of the engagement structure, such as the teeth, to disengage from each other for adjustment purposes. By utilizing the engagement structure of one or more of the rotational regions 230 provided on the members 140 of the blade attachment 130, the angle of offset and/or the distance between the blades 145 may be adjusted according to the selected relative rotational position of the portions of the members 140 joined by the components of the rotational regions 230.

[0049] The features and implementations of the blade attachments 130 may be used in combination or interchangeably. For example, pursuant to the sixth implementation of the blade attachment 130, the blades 145 may be configured to be adjustably angled relative to the rear portion 185, and pursuant to the seventh implementation of the blade attachment 130, the blades 145 may have an adjustable angle of offset relative to each other.

[0050] Returning to Fig. 2, the furrow opener 150 is positioned generally beneath the seed hopper 240 of the row unit 105. The blade attachment 130 may be arranged adjacent to and parallel with the furrow opener 150. The members 140 of the blade attachment 130 may flank the disc or discs 175 of the furrow opener 150 and extend past the trailing edge of the discs 175. When gauge wheels 125 are present, the rear portion 185 of the blade attachment 130 may be partially encompassed by the gauge wheels 125. When press wheels 120 are present, the blade attachment 130 may be arranged in front of a leading portion of the press wheels 120 so that the blades 145 of the blade attachment 130 contact and move soil into the open furrow prior to the press wheels 120 of the furrow closer reaching the soil.

[0051] The operation of the blade attachment 130 generally follows the furrow opener 150 forming a furrow and the seed metering unit 245 depositing a seed in the open furrow. The seed furrow is formed by the furrow opener 150 joined to each row unit 105. The furrow opener 150 may include two circular discs 175 rotatably mounted on the row unit 105 to form a V-shape at the point of seed placement. The discs 175 create a V-shaped seed furrow at a predetermined depth within the soil. When gauge wheels 125 are present, the gauge wheels 125 may flank the discs 175 and may support the row unit 105.

[0052] The furrow formed by the furrow opener 150 may be generally V-shaped, with a bottom portion forming the vertex where the upwardly and outwardly extending sidewalls

intersect. The furrow maintains the V-shape until closed by the blade attachment 130 and, when present, the press wheels 120 of the furrow closer.

[0053] The seed tube 190 extends downwardly from the metering unit 245, between the discs 175, and is positioned directly over the seed furrow adjacent to the rear of the double disk blades, as shown in Fig. 2. The seed tube 190 may attach to and extend downwardly from the meter unit 245. The seed tube 190 guides the seeds to the furrow, and a furrow cover 195 affixed to, but trailing the seed tube, reduces seed bounce as the seeds exit seed tube to help position the seeds in the furrow. After the seed is placed in the furrow, and fertilizer is applied on the seeds or nearby, as desired, the furrow is closed.

[0054] The blades 145 of the blade attachment 130 engage the ground on either side of the furrow. The rear portions 185 of each of the members 140 extend at an angle relative to the center line of the furrow, such that the end of the rear portion 185 is closer to the furrow than the front end of the rear portion 185. The blades 145 joined to the rear portions 185 therefore extend towards each other as the blades 145 extend toward the free end 160 of their respective members 140. As the blades 145 move along the soil, the blades 145 cut or break apart the soil at the outside regions of the open furrow and push the cut soil into the open region of the furrow. This movement of the soil by the angled blades may close or partially close the furrow and overlay the seeds with soil. The extension angle of the member 140, and the shape of the blade 145 on each rear portion 185 of the member 140, may cause the blade 145 on either side of the furrow to cut and push the dirt over the top of the furrow as the planter unit 100 is pulled along the surface.

[0055] Because the members 140 from which the blades 145 extend may flex relative to the attachment structure 135, or relative to the front portion 165 of the members 140, the members 140 or a portion thereof are resilient and deflect from an at rest position as a biasing force is exerted against the blades 145 and/or the members 140. For example, as the planter unit 100 travels across the soil, the members 140 and/or the blades 145 contacting elevated areas of the soil may deflect upwardly while maintaining some contact with the soil in order to push soil into the open furrow. Where the members 140 and/or the blades 145 contact recessed areas, the weight of the members 140 and the flexibility of the members may cause the members 140 and the blades 145 to sink into the recessed areas to maintain some contact with the soil in order to push soil into the open furrow. This arrangement enables the blade attachment 130 to resiliently ride along the contours of the soil in varying soil (or residue) conditions while the blades 145 maintain a constant pressure in the soil to cut into, break apart and/or push the soil into the open furrow.

[0056] The position of the attachment structure 135 may also be adjusted relative to the planter unit 100 to increase or decrease downward pressure exerted in the soil by the blades 145 and in some implementations, the braces 210. For example, the blade attachment 130

may be adjustable to perform at a variety of depths and at a variety of angles. For example, the attachment structure 135 may include two or more holes for use in adjusting the depth of the blade attachment 130 relative to the planting unit 100 or other implement. The attachment structure 135 may also have two or more holes for adjusting the angle of the blade attachment 130 relative to the planting unit 100 or other implement. With reference to Fig. 9, for example, the blade attachment 130 is connected with the center two of a four hole layout. As such, the blade attachment 130 may be adjusted upward or downward by a hole spacing, and the blade attachment 130 shown may include at least three vertical position options.

[0057] In some implementations, a distance between the blades 145 at their leading ends may be wider than a furrow width formed by the furrow opener 150. A center point of this distance between the blades 145 may correspond to the center or vertex of an open furrow. As the planter unit 100 moves along the soil, the leading ends of the blades 145 may contact an outer portion of the opened furrow and move at least a portion of this soil inwardly towards the open furrow. Because the size of the blades 145 increase and the distance between the blades 145 decreases as the blades 145 extend towards the free ends 160 of the members 140, the soil from the open furrow is increasingly contacted by the blades 145 and urged into the open furrow.

[0058] Because the blades 145 of the blade attachment 130 may be adjustable, the extent the blades 145 contact and push the soil into the open furrow may be adjusted. For example, when the blade attachment 130 is used in connection with a press wheel 120, the blades 145 may be angled, adjusted or separated by a distance so that the blades 145 engage and push some of the soil into the furrow. When the blade attachment 130 is used instead of a press wheel 120, the blades 145 may be angled, adjusted or positioned relatively closer together (e.g., at the bottom edges and/or rear edges) so that the blades 145 engage the soil and push all or a substantial portion of the soil into the furrow. In another example, the blades 145 may be adjusted based on soil conditions, the speed of movement of the blade attachment 130, the weight of or the arrangement of the blade attachment 130 relative to the planter unit 100 and/or the soil, and so on.

[0059] Providing the blade attachment 130 closely adjacent to the discs 175 and at the trailing edge of the seed tube 190 and furrow cover 195 allows the disc 175 and blades 145 of the blade attachment 130 to follow the same ground contours and terraces over relatively shorter distance gap compared to the distance between the disc 175 and the press wheel 120 of the furrow closer. This enables the blades 145 to contact the open furrows along the same or a similar plane to the plane the furrows were opened, which may allow the soil to be pushed into the furrows along the same or similar plane.

[0060] Providing the members 140 along the outer surface of the discs 175 may enable the members 140 to push any soil traveling up the rotating discs 175 away and down from the rotating discs 175, which may facilitate rolling of the discs 175 about the hub 180. In addition, because the blades 145 are joined to the sprung or otherwise flexible members 140, the blades 145 may shed residue that might otherwise plug the blades 145.

[0061] When press wheels 120 of a closing unit are utilized, the blade attachment 130 may partially close the furrow and place the remaining soil in a central area between the free ends 160 of the members 140. Where the press wheel 120 is centered behind the free ends 160 of the members 140, the press wheel 120 may press the centrally formed row of soil into the furrow.

[0062] Utilizing the blade attachment 130 in front of the press wheels 120 of the closing unit may also enable the planter unit 100 to use less downward pressure on the press wheel 120 due to the blade attachment 130 pushing soil into the furrow, thus making it easier for the press wheel 120 to compact soil around the seed. That is, because the blades 145 of the blade attachment 130 break apart compacted soil and fill the furrow with soil, the press wheel 120 may press soil around the seed for better seed to soil contact.

[0063] In implementations utilizing one or more braces 210 in connection with the blades 145, the braces 210 may be positioned to function in the manner of the blades 145 described above.

[0064] As described above, the blade attachment 130 may be used alone or in combination with a press wheel 120 of a furrow closer. In addition, the blade attachment 130 may be positioned on the planter unit 100 in place of the gauge wheels 125. When gauge wheels 125 are replaced by the blade attachment 130, the components associated with the gauge wheels 125, such as gauge arm bushings, gage arms, gage bearings, tires and the like, may also be removed. This may reduce maintenance work and grease time when planting. In addition, by removing the gauge wheels 125 between the row units 105, planter units 100 may be configured for narrower row spacing, and the planter units 100 may be lighter, which may simplify lift and transport as well as energy costs.

[0065] The blade attachments 130 may be utilized in connection with a number of planter units including: double disc drills; single disc drills; planter units that have double disc openers; planter units with single disc openers; shoe-type drills and planter units; and the like. The blade attachments 130, for that matter, may be used with any implement device or system.

[0066] While particular attachment techniques, devices, and locations have been shown and described, the blade attachments 130 may be attached with one or a combination of several techniques or devices and in many locations. For example, the blade attachments 130 may be bolted, welded, friction fit, hooked, clamped, or otherwise secured to the planting unit 100

or other implement. In such embodiments, the blade attachment 130 may include a suitably shaped attachment structure 135. Further, as needed, holes, slots, or the like may formed in the attachment structure 135. Moreover, while the blade attachment 130 may be secured to the planting unit 100 or other implement in front of the furrow openers 150 as shown, the blade attachment 130 may also be secured on the openers 150. For example, with reference to Fig. 8, the blade attachment 130 may be secured to the axles 250 of the opening discs 175. Where the axles 250 are stationary and the discs 175 include a bearing for spinning about the stationary axle 250, the blade attachment 130 may be keyed to the axle 250, bolted to the axle 250, welded to the axle 250, or otherwise secured thereto. In another embodiment and with reference to Fig. 9, the blade attachment 130 may be suspended from the row unit 105 above the openers 150, or the blade attachment 130, with reference to Fig. 10, may be suspended from the row unit 105 behind the furrow opener 150. In Figs. 8-10, a pair of blade attachments 130 may include two separate pieces attached to each side of a furrow opener 150, each extending generally parallel to and free of one another to a position to contact the soil and close the furrow. In other embodiments, the pair of blade attachments 130 may be tied together at a point beyond the furrow opening discs 150 or at any point where the path between two adjacent blade attachments 130 is free of obstruction. In other embodiments, a single blade attachment 130 adapted to close the furrow from a single side may be provided, and the blade 145 may include a returning portion to capture soil or debris from the opposing side of the furrow.

[0067] At least some of the materials used for the blade attachment 130 may be generally wear resistant. For example, one or more portions of the blade attachment 130 may be constructed from an abrasive resistant material (ARM) for purposes of durability. The portions of the blade attachment 130 may include hardened faces for durability. In some embodiments, the blades 145 of the blade attachment 130 may include a cutting edge to remove dirt.

[0068] The blade attachment 130 or portions thereof may also be replaceable as a whole or individually. As such, the attachments between the blade attachment 130 and the planting unit 100 or implement may be releasable, and the attachments between the several parts or components of the blade attachment 130 may be releasable. Other more permanent attachments may also be provided.

[0069] The blade attachment described may offer several advantages relating to the flexibility of the member portion. For example, the flexible member portion may allow trash to flow in no till conditions. The flexible nature of the members may allow them to flow over rocky conditions and may generally resist breakage.

[0070] All directional references (e.g., upper, lower, upward, downward, left, right, leftward, rightward, top, bottom, above, below, inner, outer, vertical, horizontal, clockwise, and

counterclockwise) are only used for identification purposes to aid the reader's understanding of the examples of the disclosure, and do not create limitations, particularly as to the position, orientation, or use of the disclosure unless specifically set forth in the claims. Joinder references (e.g., attached, coupled, connected, joined, and the like) are to be construed broadly and may include intermediate members between a connection of elements and relative movement between elements. As such, joinder references do not necessarily infer that two elements are directly connected and/or in fixed relation to each other.

[0071] In some instances, components are described with reference to "ends" having a particular characteristic and/or being connected with another part. However, those skilled in the art will recognize that the present disclosure is not limited to components which terminate immediately beyond their points of connection with other parts. Thus, the term "end" should be interpreted broadly, in a manner that includes areas adjacent, rearward, forward of, or otherwise near the terminus of a particular element, link, component, part, member or the like.

[0072] In methodologies directly or indirectly set forth herein, various steps and operations are described in one possible order of operation, but those skilled in the art will recognize that steps and operations may be rearranged, replaced, or eliminated or have other steps inserted without necessarily departing from the spirit and scope of the present disclosure. It is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative only and not limiting. Changes in detail or structure may be made without departing from the scope of the disclosure as defined in the appended claims.

[0073] Although the present disclosure has been described with respect to particular apparatuses, configurations, components, systems and methods of operation, it will be appreciated by those of ordinary skill in the art upon reading this disclosure that certain changes or modifications to the embodiments and/or their operations, as described herein, may be made without departing from the scope of the disclosure. Accordingly, the proper scope of the disclosure is defined by the appended claims. The various embodiments, operations, components and configurations disclosed herein are generally exemplary rather than limiting in scope.

CLAIMS

What is claimed is:

1. A blade attachment for use with a planter unit, comprising:

a first member and a second member extending from an attachment structure, the first member and second member each terminating in a free end at a rear portion of each member;

a first blade extending from the rear portion of the first member; and

a second blade extending from the rear portion of the second member;

wherein the rear portion of the first member and the rear portion of the second member taper towards each other; and

the blades are configured to close a furrow formed by the planter unit by pushing soil into the furrow.

2. The blade attachment of claim 1, wherein the attachment structure is configured to be joined to the planter unit at a front portion of the planter unit.

3. The blade attachment of claim 2, wherein the first member is configured to extend on a side of the furrow opener of the planter unit, and the second member is configured to extend on another side of the furrow opener.

4. The blade attachment of claim 3, wherein the free end of the rear portion of the first member and the free end of the rear portion of the second member are configured to trail the furrow opener.

5. The blade attachment of claim 2, wherein the free end of the rear portion of the first member and the free end of the rear portion of the second member are configured to trail a seed tube of the planter unit.

6. The blade attachment of claim 1, wherein the first blade extends downwardly from the rear portion of the first member.

7. The blade attachment of claim 1, wherein the blade attachment is configured to be positioned in front of a press wheel of a furrow closer of the planter unit.

8. The blade attachment of claim 1, wherein the first blade comprises a tapered shape.

9. The blade attachment of claim 1, wherein the first blade is detachably joined to the rear portion of the first member by a boss and fastener connection.

10. The blade attachment of claim 9, wherein the first blade comprises a double-edged blade with a first blade edge at a top portion of the first blade and a second blade edge at a bottom portion of the first blade.

11. The blade attachment of claim 1, further comprising a fertilizer tube extending along the first member and terminating at a tube opening proximate a rear portion of the first blade.

12. The blade attachment of claim 11, wherein the tube opening trails the first blade.

13. The blade attachment of claim 1, wherein the first blade is adjustable relative to the rear portion of the first member.

14. The blade attachment of claim 13, wherein the first blade comprises a bottom edge for contacting soil, and the first blade is adjustable such that a bottom edge of the first blade is angled relative to the rear portion of the first member.

15. The blade attachment of claim 13, wherein the first blade comprises a rear edge at the free end of the first member, and the first blade is adjustable such that an angle of offset of the rear edge is adjustable.

16. The blade attachment of claim 13, wherein the first blade is adjustable such that a distance between the first and second blades is adjustable.

17. A method for closing a seed furrow, comprising:
forming an open furrow utilizing a furrow opener of the planter unit;
depositing a seed in the open furrow utilizing a seed tube; and
closing the furrow using blades of a blade attachment joined to the planter unit, wherein the blades push soil into the open furrow and the blade attachment comprises a first member and a second member extending from an attachment structure, the first and second members tapering towards each other at a rear portion for the blade attachment, and each blade extends from a rear portion of one of the first and second members.

18. The method of claim 17, further comprising using a press wheel to press the soil of the closed furrow.

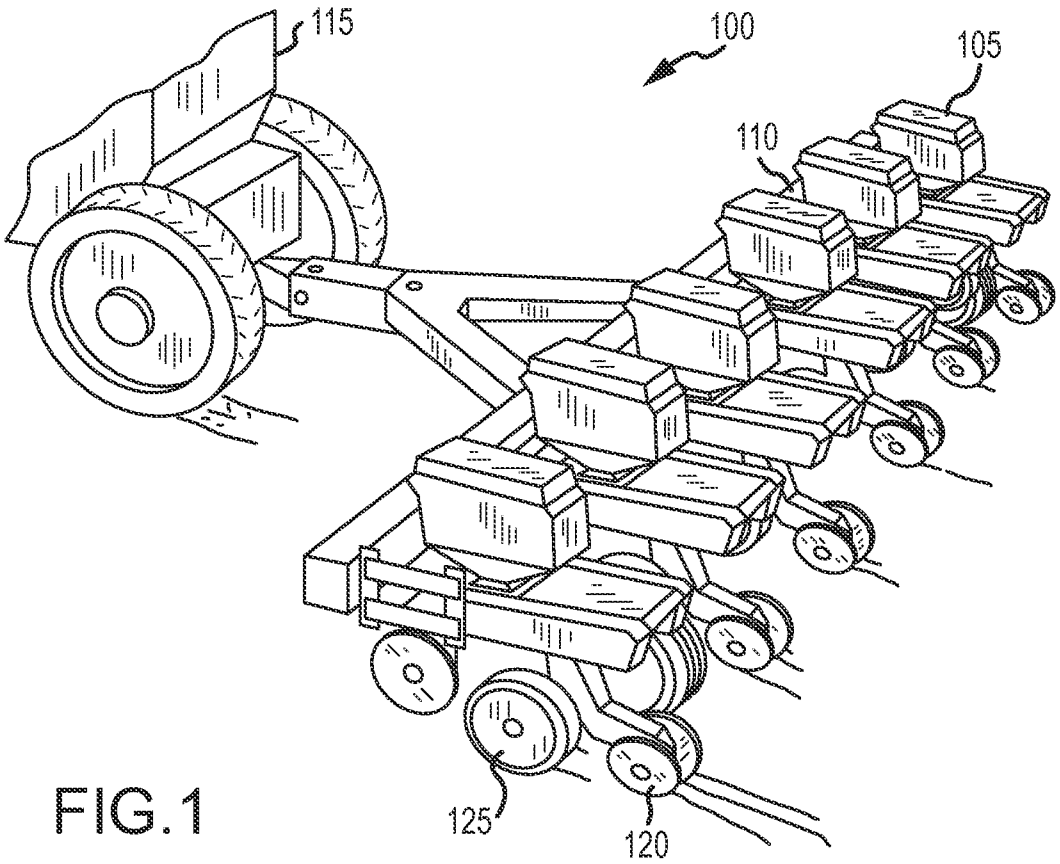
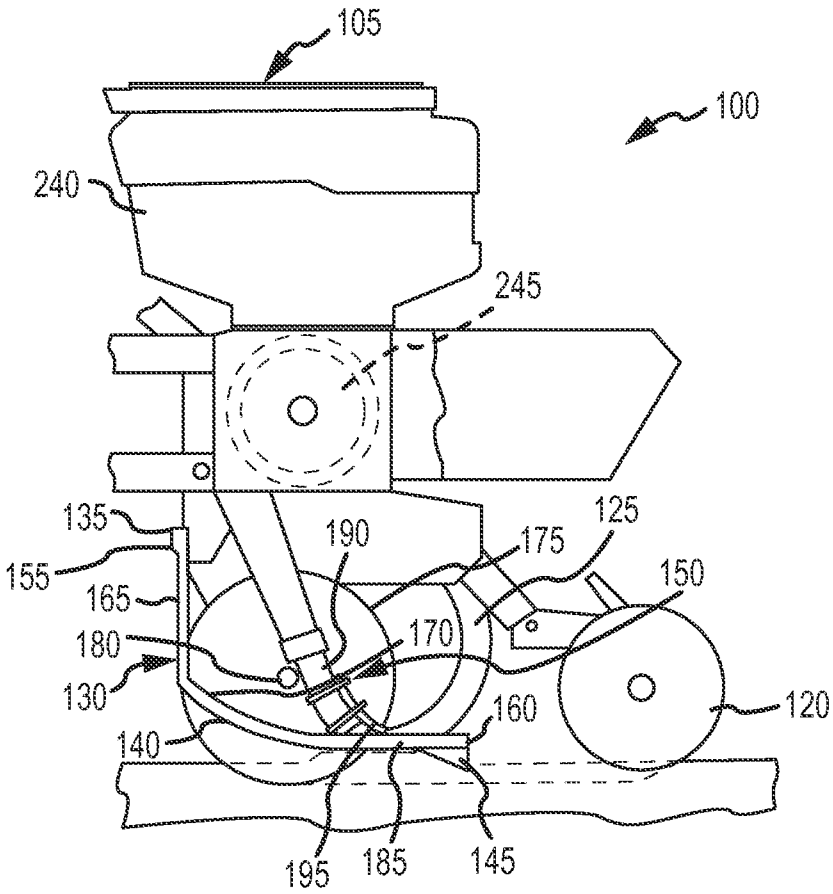


FIG.1


105
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195
185
145

FIG.2

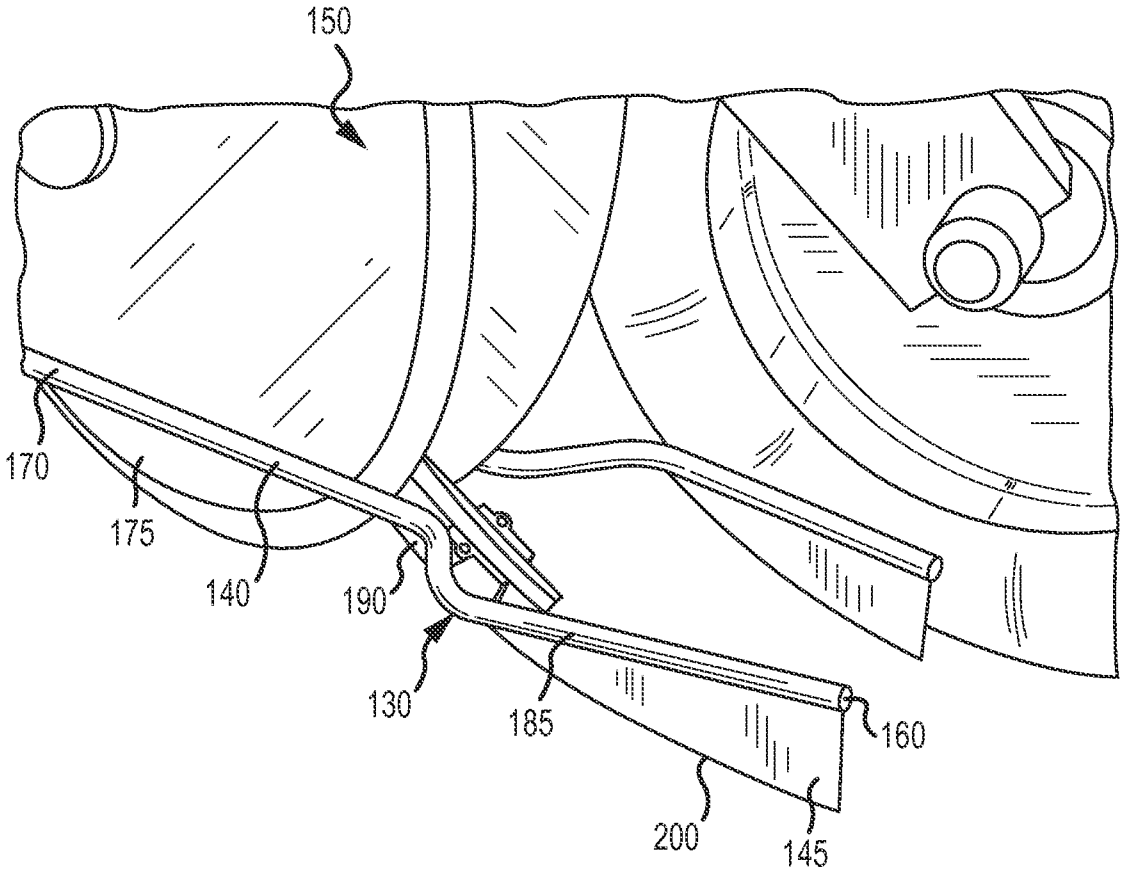


FIG.3

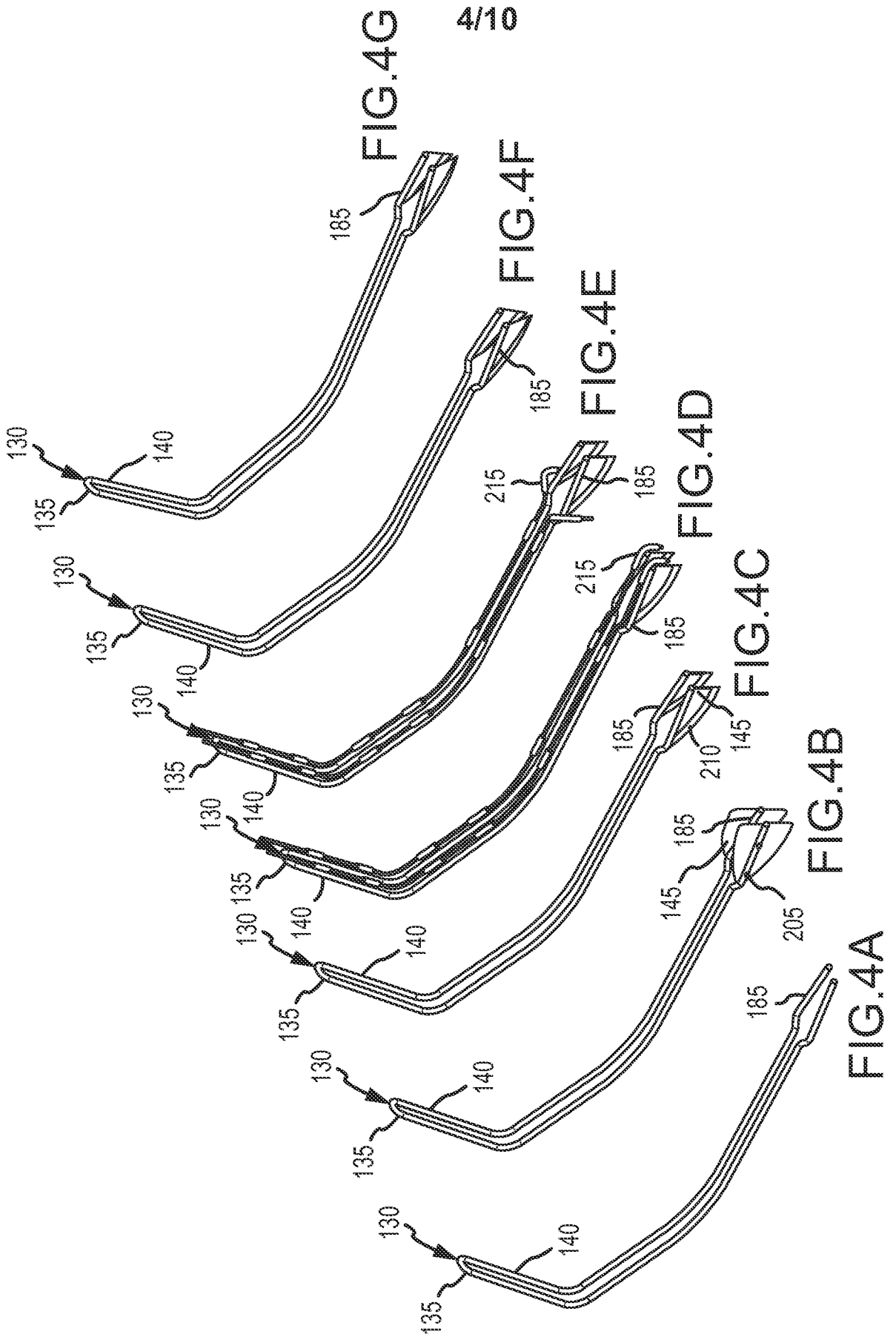


FIG.4A FIG.4B FIG.4C FIG.4D FIG.4E FIG.4F FIG.4G

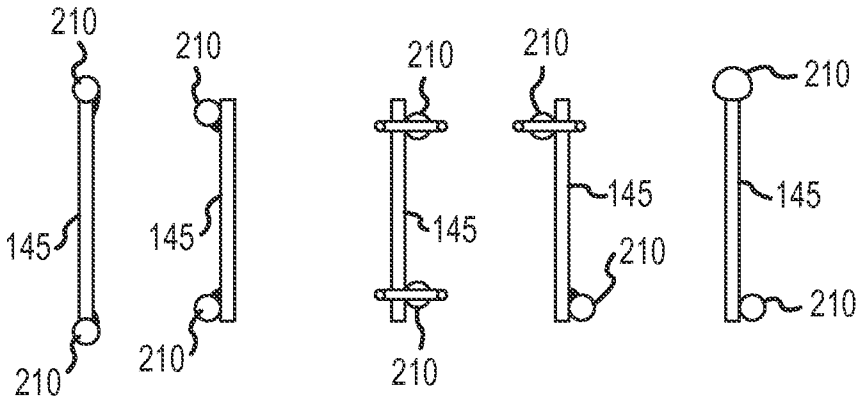


FIG.5A

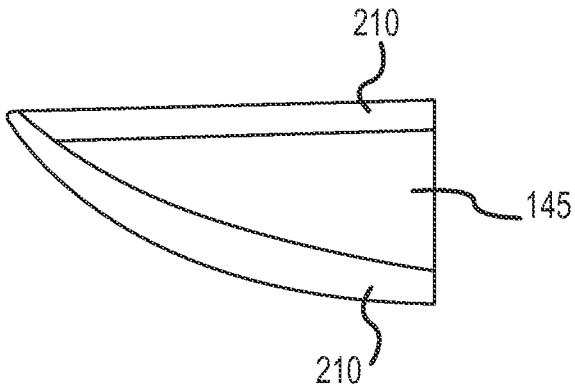


FIG.5B

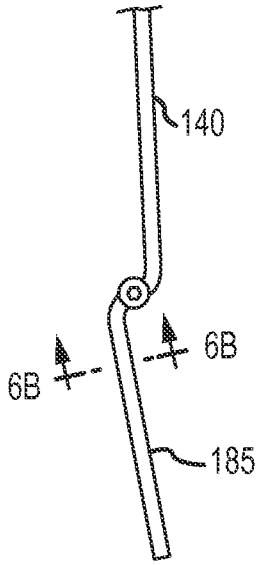


FIG.6A

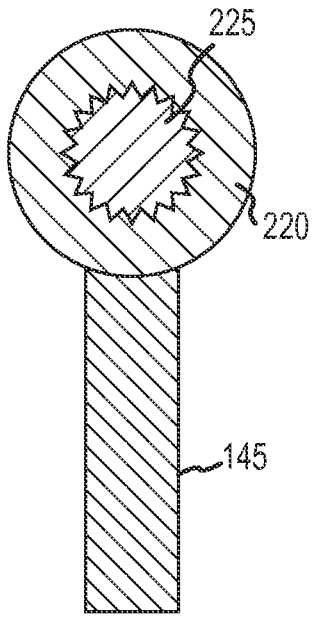


FIG.6B

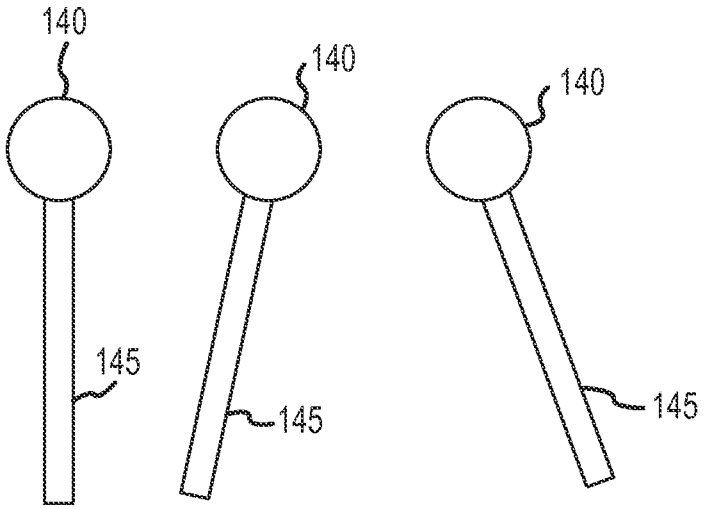
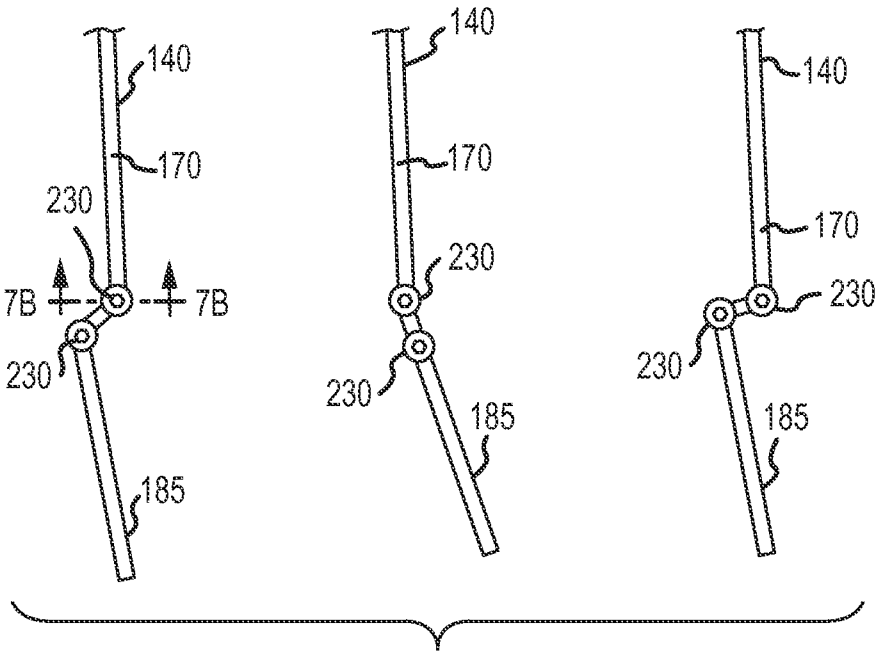


FIG.6C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7B
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FIG.7A

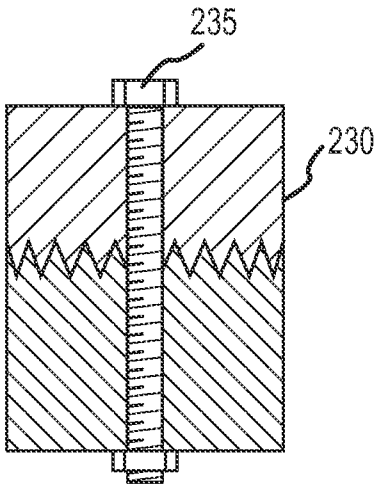
235
230

FIG.7B

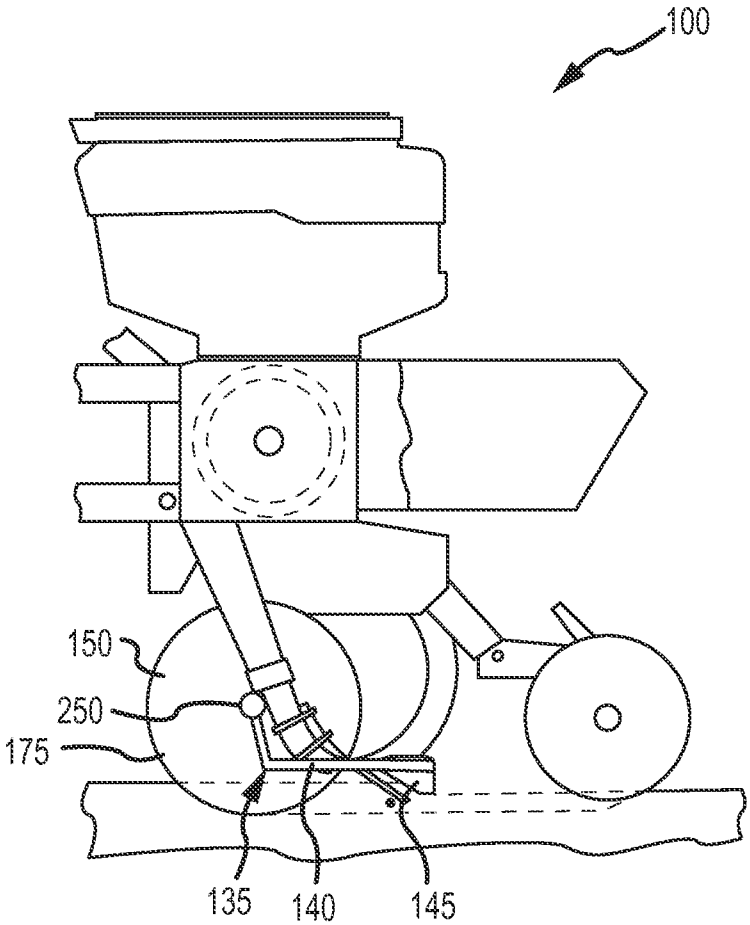

FIG.8

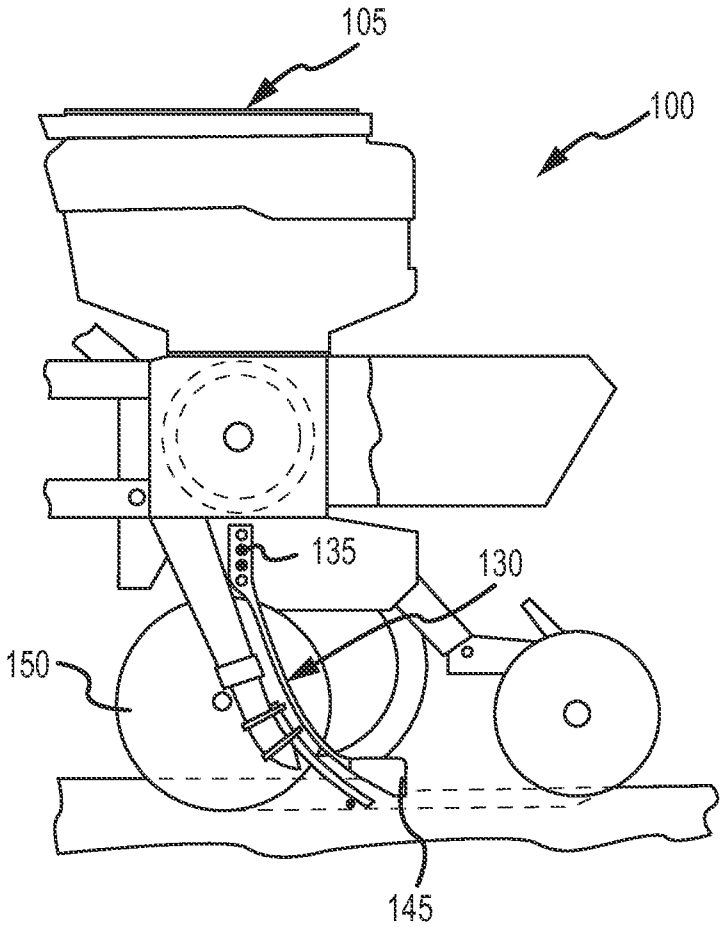

FIG.9

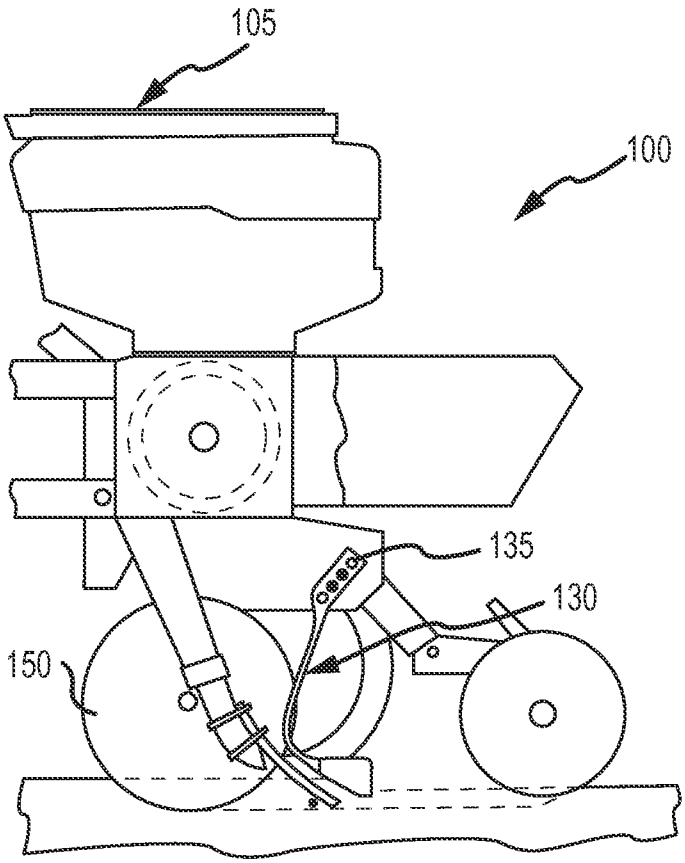

FIG.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/34536

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A01B 5/00, A01B 49/02 (2012.01)
USPC - 111/190
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC- 111/190, 197, 14, 62 172/176, 72, 179, 180, 716
IPC(8) A01B 5/00, A01B 49/02 (2012.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Google Scholar: furrow, seed, plant, cover, blade, coulter.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Dialog: databases 340, 349, 351, 654
Keywords: furrow,closing, seed, drill, planter, blade, cover, angle, rake, drag, push, scrape, ditch, trench, groove, agriculture.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 359,832 A (Arnett) 22 March 1887 (22.3.1887) Figs. 4-5, and pg. 2, lines 105-115.	1-10, 17 ---- 11-16, 18
Y	US2,968,266 A (Gustafson) 17 January 1961 (17.01.1961) col. 3, lines 25-45.	11-12
Y	US 3,815,528 A (Hawkins) 11 June 1974 (11.06.1974) Figs. 1, 2. and col. 3, lines 40-65.	13-16
Y	US 3,023,718 A (Sorenson et al.) 6 March 1962 (06.03.1962) Fig. 1, and col. 3, lines 35-50.	18
A	US 1,688,934 A (Lynch) 23 October 1928 (23.10.1928) Fig. 3	1-7, 17
A	US7,921,787 B2 (Sauder et al.) 12 April 2011 (12.04.2011)	11-12

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 June 2012 (14.06.2012)	11 JUL 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)